



GLAST Monthly PSR

Spacecraft

July 2, 2003

Joy Bretthauer
Observatory Manager

- 1



Accomplishments

- ▶ **SC PDR: May 5-8, 2003; Spectrum Astro**
 - 43 SC RFAs & 10 recommendations; 14 FSW RFAs
 - Closure plan with responsible persons assigned
 - Spectrum successfully demonstrated their designs were at a PDR-level.
 - Per the Code 300 review committee and the IRT....
Spectrum Astro has adequately demonstrated that the preliminary design addresses the systems requirements with acceptable levels of risk. Suitable trade studies have been conducted, interfaces have been identified, and verification methods have been satisfactorily described. The PDR has successfully established the basis for proceeding with the detailed design."

- ▶ **GLAST MPDR June 3-4, 2003 GSFC**
 - Presented S/C & Observatory Overview
 - RFAs received for Observatory pointing analysis, availability of hotbench



Accomplishments: Staffing



► **Spectrum Astro: Systems Engineering Staffing**

– SE Staffing has been augmented with Jim Howe and James Cody



Accomplishments: GFE to S/C

- ▶ **GBM FEM Model:** *Due 6/03; Received*
- ▶ **LAT FEM Model:** *Reduced Craig-Bampton for CLA*
 - *Initial due 9/02: Received 1/13/03*
 - *Preliminary due 6/03: OPEN – not received*
 - *Final due 6/05*
- ▶ **LAT Reduced Thermal Model:** *Due PDR-2m: OPEN – not received*
 - *SC PDR-2 months: OPEN – not received*
 - *SC CDR-2 months:*
 - *Instr T/V + 2 months:*
- ▶ **LAT CAD model (STEP format) [Full-up LAT external model]**
 - *SRR-1month Received 9/25/02*
 - *SC PDR-2months (3/5/03): OPEN*
 - *SC CDR – 2 months (12/03)*
- ▶ **NASA Frequency Auth.** *Due 4/03: OPEN*
 - *Application in progress for S-band uplink/downlink frequencies; no schedule impacts at this time*
- ▶ **LV Coupled Loads Analysis** *Due 1/03: OPEN*
 - *CLA schedule is being updated.*
- ▶ **Upcoming GFE:**
 - *GSE PAF: MCDR – 4 months*



Accomplishments: Deliverables



► **S/C Deliveries:**

- GBM Detector locations, geometry of obstructions, etc: 6/5/2003
- GBM SIIS to MSFC: (due May 19, 2003) 6/11/2003
 - Some documentation was not included; follow-up to get it sent
- LAT SIIS: Scheduled for July 8, 2003
 - Acceptance Test Started @ Spectrum: July 1, 2003
 - Demo for Dan Wood & Tony Waite @ Spectrum: 6/24 – 6/26, 2003

► **Upcoming Deliverables:**

- *PWB coupons:* 2 weeks prior to board population
- *Math model of S/C for GBM* December 2003
- *LAT-to-S/C mount drill template* CDR – 4 months
- *Observatory Scale Model* 1 @ CDR; 24 @ CDR + 3 months



Accomplishments: Task Status

► Task Studies Submitted for CTR:

- Task Study #5: Structural Thermal Analysis May 02, 2003
- Task Study #6: GLAST Scale Model May 16, 2003
- Task Study #7: MECO June 02, 2003
- Task Study #8: Additional Redundancy: June 23, 2003
- Task Study #9: Solar Array Kapton: June 24, 2003

► Proposals Received / Tech Eval Approved:

- Task Study #3: Ku-Band:
 - Start: May 27, 2003
- Task Study #4: C&DH Cross-Strapping & LAT Harness
 - Received: May 21, 2003 Approved: June 19, 2003
- Task Study #5: Structural Thermal Analysis:
 - Received: May 21, 2003; Approved: June 19, 2003
- Task Study #6: GLAST Scale Model
 - Received – June 2, 2003 ; Shipping Report: June 3, 2003; Approved: June 11, 2003
- Task Study #7 MECO:
 - Received: June 5, 2003; Approved June 11, 2003; Start: June 17, 2003
- 11th battery cell for Option 6 Battery Life Test Battery
 - Received: April 2003; Approved: June 30, 2003



Accomplishments: Contract

- ▶ CDRLs due at PDR were received.
- ▶ Project CDRL library/database/review tool being developed.
- ▶ CDRL Review Meeting: Every Monday from 10am-12pm, starting 7/14/2003.
 - Agenda out by 7/7 for those pending approval.
- ▶ Request to prioritize CDRLs for review/approval: June 2, 2003
 - The government respectfully requests that Spectrum-Astro compose a spreadsheet of the recently delivered CDRLs and:
 1. prioritize them according to their need and
 2. recommend a government respond by date.

The SC delivery order does not have government response due dates for those CDRLs requiring government approval. Spectrum's generation of this list will assist the government with its review process and ensure that the government's input is included in your development cycle. This will also assist with managing the manpower necessary to review all the documents.

Thank you in advance.



Accomplishments: S/C Subsystems

► **GNC/Eric Stoneking & S/C SE-Chris Connor:**

- *Reaction Wheel CDR @ Ithaco – 6/18/03; 6/19/03 – Star Tracker CDR@ Goodrich*
 - *Both reviews were positive. RFAs were taken.*
- *Upcoming: Star Tracker Testing – 7/15/03*

► **C&DH/Joe Sonsino:**

- *SSR PDR @ SEAKR – 6/5/03*
 - *Although RAD 1750 processor used for SSR is obsolete, many parts were procured & stocked. Thermal Vac testing will be done at Spectrum. Except for vibration & EMI testing, all testing will be done at SEAKR.*
- *Recommendation for 8 bit SC ID accepted & implemented.*

► **Power/Ed Gaddy & S/C SE -Chris Connor:**

- *Battery PDR @ Eagle Picher– 6/26/03*
 - *Delivery of I&T battery: scheduled for April 2004*
- *Submitted SOW info for Task Study #9: Solar Array Kapton & provided clarification regarding Task purpose*



Accomplishments: S/C Subsystems

► ***Thermal / Lou Fantano:***

- *Provided input on thermal cases for Task Study #5 – Structural Thermal Analysis*

► ***Observatory I&T / Ed Shippey:***

- *Supported Spectrum-led I&T TIM @ SLAC*
- *Risk Mitigation Activity: Facility of the Future*
 - *Branch contacted Spectrum's facility manager in response to request for information to use GSFC facilities for I&T*
 - *Work in progress:*
 - *Identifying AETD personnel to review FOF schedule, capability, facility plan, & commission plan*
 - *In progress: Obtain detailed FoF schedule; draft agenda & schedule for GLAST project recommended review*

► ***RF Com/Peter Acosta:***

- *Supported Ku-band status via telecom*

► ***FSW/Erik Andrews:***

- *See FSW MPSR charts*



Accomplishments: Subsystems

► **Electrical/EMI/EMC – Fred Blanchette:**

- *S/C Bus Bars: reviewed & received concurrence to eliminate bus bars*
- *Reviewing SAI EMI testing cost/schedule impacts*
- *Reviewed SAI draft EMI Control Plan*

► **Mechanical/Sharon S, Farhad M, Chris F., Mike G.:**

- *Identified schedule slips in mechanical area of Spectrum's schedule*
- *Identified problems with Spectrum's initial observatory CB model and LTM.*
 - *Validated new CB model and LTM. Recommended that KSC/Boeing restart the GLAST early CLA using the newly validated data.*
- *Performed 1g base-drive analysis (up to 50 Hz) with Spectrum's observatory reduced Craig-Bampton (CB) model and Load Transformation Matrix (LTM)*
 - *Responses at critical points (e.g., top corner of ACD, lower corner of the radiators) were compared to results obtained by Spectrum Astro using the observatory NASTRAN model.*
- *Followed-up on SAs ability to produce MGSE early along with the flight Optical Bench (OB) 'ahead-of-schedule' to allow its use to correlate the spacecraft FEM pre-CDR, in order to reduce uncertainty for the next CLA.*
 - *OB design is not sufficiently mature to begin building the flight article ..only option would be the fund production of an Engineering Model OB, which is doubtful at this time.*



Issues/Problems: New

► **EMI/EMC Test Requirements:**

- Differentiating baseline vs. new requirements per EMI Req. Doc.
- Obtaining cost/schedule impacts necessary for CCB

► **Ku-band:**

- Approx. 5 month schedule impact; Spectrum requests HSDL decision
- Design impacts: larger chassis & add HSDL (high speed downlink board); decide on 40 vs. 75 Mbps; Cross-strapping science data into SSR ?
- Opportunity to recapture card for battery cell voltage monitoring

► **LAT SIIS Acceptance Test: as of 7/2/03**

- Recommendation for maintaining delivery of LAT SIIS:
 - Due to the "Ready Flag Test" (don't send science data for x-time until SSR is ready to receive data) and a failed script (manual command works), the acceptance test would be redlined to exclude everything except non-1553 testing. FSW or FPGA problem. This would permit unit to be shipped on schedule. Otherwise, schedule slip until problem is resolved (1day? 1week?)
- 1553 scripts are functional; acceptance testing still in progress
- Ready Flag Test & failed script are in a section that will not be used at NRL until after the LVDS mods are incorporated.
- Entire Acceptance Test will be repeated after LVDS upgrades are installed



Issues/Problems: Previous

- ▶ In Progress: Task Study #5 Structural Thermal Analysis Analysis & Verification of Observatory Pointing Knowledge
 - Analysis requires LAT participation to properly model the grid out of plane motion wrt the LIP:
 - IMPACTS – early results for insight in meeting pointing knowledge requirement; cost/schedule for SC or LAT if post-LAT CDR design changes are necessary
- ▶ OPEN:
 - Mission Ops Training Simulator: Identified additional LAT/GBM instrument simulators (s/w or h/w) necessary to support
- ▶ Orbit insertion altitude: @ 525 km initial altitude lifetime < 5yrs.
- ▶ In Progress:
 - Slew Rate Requirements not being met with 1, failed reaction wheel
- ▶ Closed: Draft Project Contamination Control Plan received:
 - non-existent; draft in-progress; basis of other spacecraft requirements per S/C MAR
- ▶ Closed: James Cody & Jim Howe were added;
 - Systems Engineering Staffing @ SAI: requires additional manpower to support design trades, ROMs, special studies, etc.



Upcoming Meetings

- ▶ **July 8:** ***X Band Transmitter TIM at CMC***
- ▶ **July 14 – Sep 30:** ***FSW Peer Review at SA***
- ▶ **July 23:** ***Solar Array PDR at Emcore***
- ▶ **July 25:** ***MPSR at Spectrum***
- ▶ **Aug 5:** ***GBM DPU CDR at SwRI***
- ▶ **Dec 2:** ***GBM NaI, BGO, PSR CDR***
- ▶ **Oct. 14 – Nov. 20** ***S/C CDR Peer Reviews***
 - 10/15/03 *Systems, Ops, EMI/EMC*
 - 10/16/03 *I&T (S/C, Obs), MGSE, EGSE, Simulators*
 - 10/28/03 *Structures*
 - 10/29/03 *Mechanisms*
 - 10/30/03 *Thermal*
 - 11/5/03 *EPS*
 - 11/6/03 *RF Com*
 - 11/18 *C&DH*
 - 11/19 *GN&C*
 - 11/20: *FSW / FSW CDR*
 - TBD/1day: *Propulsion*



Upcoming Meetings




► **Oct. 14 – Nov. 20, 2003** **S/C CDR Peer Reviews**

- 10/15 *Systems, Ops, EMI/EMC*
- 10/16 *I&T (S/C, Obs), MGSE, EGSE, Simulators*
- 10/28 *Structures*
- 10/29 *Mechanisms*
- 10/30 *Thermal*
- 11/5 *EPS*
- 11/6 *RF Comm*
- 11/18 *C&DH*
- 11/19 *GN&C*
- 11/20: *FSW / FSW CDR*
- TBD: *Propulsion*



Rolling Wave Schedule

Activity	Activity	MD	Current	Free	Total	2002	2003	2004	2005
Unique IDs	Description	Start	Finish	Float	Float				
Spacecraft									
Spacecraft Development									
Spacecraft Top-Level Development/Milestones									
0037	S/C Vendor Selection	30AUG02	30AUG02						
0496	S/C Kickoff Meeting	25SEP02	26SEP02						
0043	S/C System Requirements Definition	03SEP02	19NOV02						
0139	S/C SRR	20NOV02	21NOV02						
0097	S/C Development (Preliminary System Design)	22NOV02	02MAY03						
0115	S/C PDR	05MAY03	07MAY03						
0094	S/C Development (Detailed System Design)	06JUN03	06FEB04	0	131				
0118	S/C CDR	09FEB04	11FEB04	0	131				
0046	S/C Component Fab & Test	09FEB04	15JUL04	0	19				
0555	Flight Structure Ready For Bus I&T		15JUL04	11	11				
1294	S/C Bus Eng Model Integration	27AUG04	14SEP04	0	115				
0565	S/C Bus EPS Integration	15SEP04	20SEP04	0	115				
0568	S/C Bus C&DH & SSR Integration	21SEP04	01OCT04	0	115				
1303	S/C Bus Propulsion Subsystem Integration	28OCT04	03NOV04	0	141				
1300	S/C Bus TT&C Integration	08OCT04	12NOV04	0	100				
0553	S/C Bus Prep and Harness Integration	28JUN04	08DEC04	0	115				
1297	S/C Bus ACS Integration	11NOV04	30DEC04	0	99				
1306	S/C Full Bus Functional Testing	03JAN05	18FEB05	0	99				
0052	S/C Bus Ready for Observatory I&T		25FEB05	131	159				

Start Date	03APR00		Early Bar	GL05	Sheet 1 of 1	GLAST SC Project Schedule Top-Level Milestones 7/2/03 PSR	Date	Revision	Checked	Approved
Finish Date	21DEC06		Progress Bar							
Data Date	01JUN03		Critical Activity							
Run Date	01JUL03 09:18									

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Rolling Wave Schedule

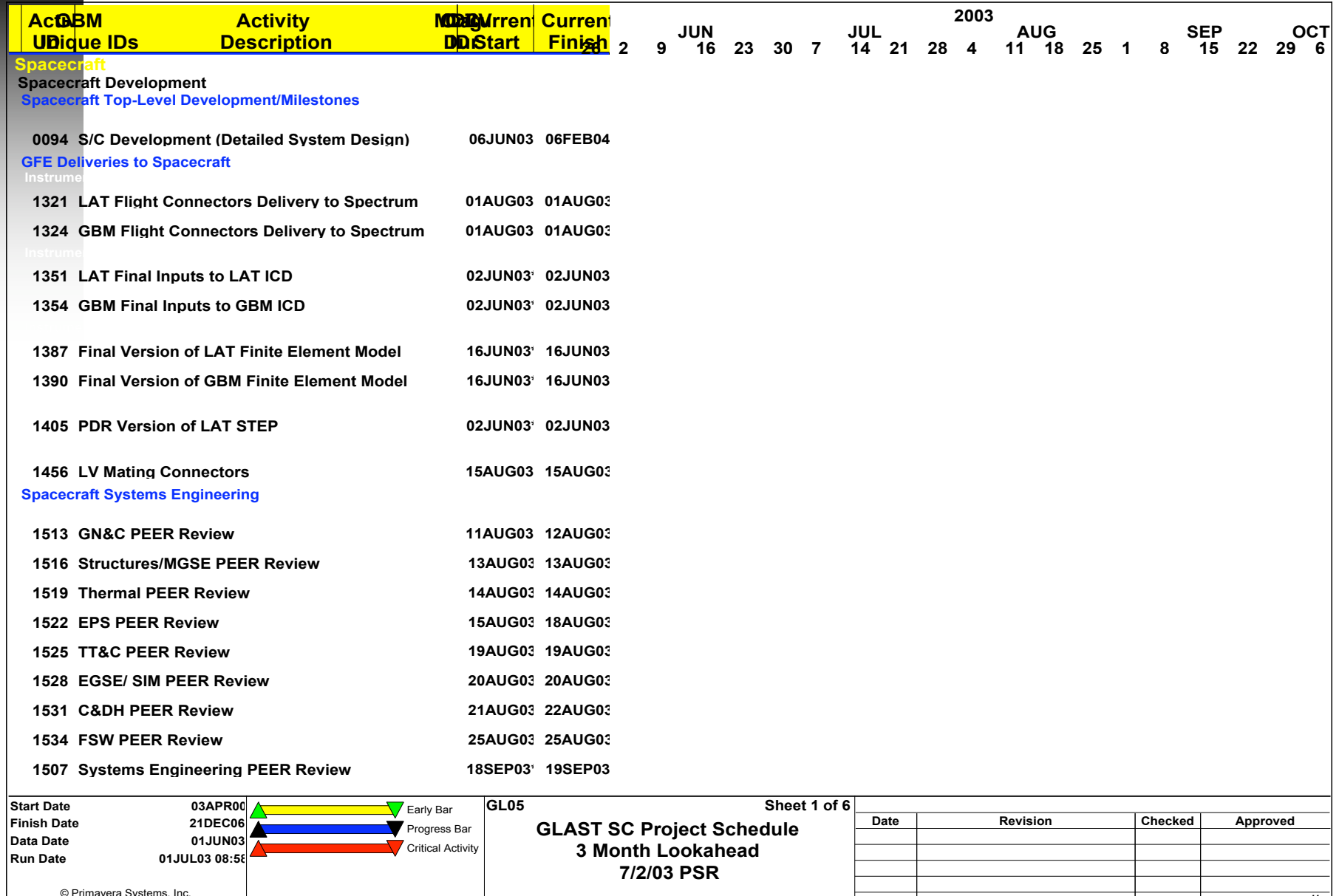


BACKUP CHARTS

Detailed, Subsystem-level Rolling Wave Schedule



Rolling Wave Schedule





Rolling Wave Schedule

Acc DBM	Activity	MDM	Current	2003																									
Unique IDs	Description	DD	Start	Finish	2	9	JUN	16	23	30	7	JUL	14	21	28	4	AUG	11	18	25	1	8	SEP	15	22	29	OCT	6	
DID-P-OB																													
1580	Incorporate Revisions to Observatory CCP		16JUN03	09SEP03																									
1582	Final Review & Signatures on Final CCP		10SEP03	30SEP03																									
1584	Submit Observatory CCP-Final		30SEP03	30SEP03																									
Spacecraft Structure & Mechanisms (SMS)																													
S/C SMS																													
1586	Optical Bench Preliminary Design		01MAY03	23JUL03																									
1588	Optical Bench Detail Design		24JUL03	16OCT03																									
S/C SMS																													
1650	X-Band Antenna Boom Detailed Design		18FEB03	18JUN03																									
1653	X-Band Antenna Boom Parts/Assy Analysis		08JUL03	18AUG03																									
1656	X-Band Antenna Boom Release Hinge & R&R Drw		19AUG03	14OCT03																									
1731	Flight Solar Array Procure Root Hinge R&R Parts		08MAY03	02JUL03																									
6000	Receive Root Hinge Bearings		10JUL03	10JUL03																									
1737	Flight Solar Array Build Root Hinge & RR Stack		11JUL03	16JUL03																									
1740	Flight Solar Array Build Test Setup		30JUL03	01AUG03																									
1755	Release Flight Solar Array Wing Assy Drawings		21JUL03	15AUG03																									
1743	Flight Solar Array Functional Tests		04AUG03	15AUG03																									
1758	Procure Parts for One Wing of Flight SAs		18AUG03	20OCT03																									
1785	Develop CM Structure Design		03SEP03	02OCT03																									
1788	Develop CM Comp Mockup Designs		18SEP03	15OCT03																									
1791	Fab Structure Components for Cable Mockup		25SEP03	26NOV03																									
1833	S/C Create Preliminary CLA Report		28MAY03	11JUN03																									
1836	S/C Receive Detailed CLA Results from KSC		04AUG03	04AUG03																									
1839	S/C Update CLA Report		05AUG03	18AUG03																									
1842	Update S/C Model (Bus FEM) to PDR-Level Design		19AUG03	30SEP03																									
2022	Procure Main PDU Chassis EM Parts		18JUN03	06AUG03																									



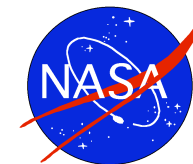
Rolling Wave Schedule

Acc DBM Unique IDs	Activity Description	DD Start	Current Finish	2003																									
				JUN 2	JUN 9	JUN 16	JUN 23	JUN 30	JUN 7	JUL 14	JUL 21	JUL 28	AUG 4	AUG 11	AUG 18	AUG 25	AUG 1	AUG 8	SEP 15	SEP 22	SEP 29	OCT 6							
2025	Assemble PDU EM Chassis	07AUG03	13AUG03																										
2028	Procure Flight PDU Parts	14AUG03	09OCT03																										
S/C SM																													
2043	Complete PRU Chassis Drawings	23APR03	04JUN03																										
2046	Procure Main PRU Chassis EM Parts	05JUN03	24JUL03																										
2049	Assemble PRU EM Chassis	25JUL03	29JUL03																										
S/C SM																													
2064	IEM Chassis Detail Design Changes	16DEC02	18JUN03																										
2067	Complete IEM Chassis Drawings	17SEP03	07OCT03																										
2088	Design Integration Stand/Dolly	15APR03	18JUN03																										
2091	Analyze Integration Stand/Dolly	15APR03	18JUN03																										
2094	Procure Integration Stand/Dolly	19JUN03	28AUG03																										
2097	Integration Stand/Dolly Ready	29AUG03	29AUG03																										
2100	Structure Tooling Preliminary Design	02SEP03	01OCT03																										
2124	Design Solar Array 1 MGSE	08MAY03	16JUN03																										
2127	Procure Solar Array 1 MGSE	17JUN03	29JUL03																										
2136	Solar Array 1 MGSE Ready		29JUL03																										
2139	Design Solar Array 2 MGSE	07JUL03	04SEP03																										
2142	Procure Solar Array 2 MGSE	05SEP03	23OCT03																										
2166	Design X-Band 1 MGSE	01JUL03	31JUL03																										
2169	Procure X-Band 1 MGSE	01AUG03	05DEC03																										
S/C Electrical Power (EPS)																													
2211	PDU Load Control Board Engineering Model	31JAN03	04SEP03																										
2217	PDU Command & Telemetry Board Design/Dev	21OCT02	02JUN03																										
2220	PDU Command & Telemetry Board Eng Model	03JUN03	05SEP03																										



Rolling Wave Schedule

Acc	OBM	Activity	MD	Current	2003																											
					JUN							JUL							AUG							SEP						
UB	IDs	Description	DD	Start	Finish	2	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29	6								
S/C EP																																
	2226	PDU Charge Control Board Design/Development	21OCT02	30JUN03																												
	2229	PDU Charge Control Board Engineering Model	01JUL03	06AUG03																												
S/C EP																																
	2235	PDU Battery Bus Board Design/Development	21OCT02	08JUL03																												
	2238	PDU Battery Bus Board Engineering Model	09JUL03	25AUG03																												
S/C EP																																
	2244	PDU Backplane Design/Development	19JUN03	28JUL03																												
	2247	PDU Backplane Engineering Model	29JUL03	26AUG03																												
S/C EP																																
	2253	PDU Engineering Model Assemble & Test	27AUG03	02APR04																												
	2265	PRU VRB Engineering Model	28MAR03	21JUL03																												
	2541	PRU Filter Switch Board Design & Analysis	03FEB03	09JUN03																												
	2556	PRU Filter Switch Board Engineering Model	12MAY03	30JUL03																												
	2586	PRU Signal Interface Board Engineering Model	23APR03	11JUN03																												
	2595	PRU PIB Engineering Model	21APR03	17JUN03																												
	2271	PRU Backplane Design & Analysis	27JAN03	03JUL03																												
	2274	PRU Backplane Engineering Model	07JUL03	05AUG03																												
	2280	PRU Engineering Model Assemble & Test	06AUG03	29SEP03																												
	2328	Generate Requirements Spec	20DEC02	27JUN03																												
	2331	Determine Flight Sep Connector Requirements	05JUN03	07JUL03																												
	2334	Order Placed for Flight Sep Connectors	07JUL03	07JUL03																												
	2337	Determine Component Connector Types/Sizes	24MAR03	31JUL03																												
	2340	Collect/Process Component Pinout Info	30APR03	31JUL03																												
	2343	Build Harness Database	01AUG03	24OCT03																												



Rolling Wave Schedule

Acc DBM	Activity	MDM	Current	2003																									
Unique IDs	Description	DD Start	Finish	2	9	JUN 16	23	30	7	JUL 14	21	28	4	AUG 11	18	25	1	8	SEP 15	22	OCT 29	6							
S/C Command & Data Handling (C&DH)																													
S/C C&D																													
2621	OCXO EM 1 Unit Delivered	15AUG03	15AUG03																										
2623	OCXO EM 2 Unit Delivered	15AUG03	15AUG03																										
S/C C&D																													
2424	ARM Design & Analysis	16DEC02	29AUG03																										
S/C C&D																													
2442	GPIO Design & Analysis	25NOV02	14JUL03																										
2445	GPIO Engineering Models Development	15JUL03	30OCT03																										
S/C C&D																													
2454	NVM Engineering Models Development	02JAN03	07AUG03																										
2460	IPCU Design & Analysis	18FEB03	15JUL03																										
2463	IPCU Engineering Models Development	16JUL03	12NOV03																										
2469	PACI Design & Analysis	13JAN03	28JUL03																										
2472	PACI Engineering Models Development	29JUL03	09DEC03																										
2487	LGIO Design & Analysis	01OCT02	30JUN03																										
2490	LGIO Engineering Models Development	01JUL03	20OCT03																										
2496	UDL Design & Analysis	01OCT02	18JUL03																										
2499	UDL Engineering Models Development	21JUL03	05DEC03																										
2505	cPCI Backplane Design & Analysis	27JAN03	03SEP03																										
2508	cPCI Backplane Engineering Models Development	04SEP03	31OCT03																										
S/C Flight Software																													
2538	Mission CSCI Build 1, 2, 3 & 4	13JAN03	24JUN03																										
2550	ISM CSCI Build 1, 2 & 3	21JAN03	01AUG03																										
2574	Code, Integ & Test Mission CSCI Build 1-SIM Sup	01NOV02	09JUN03																										
2577	Code, Integ & Test Mission CSCI Build 2-GN&C S	25JUN03	30OCT03																										
3333	ISM CSCI Build 1 Integration & Test	04AUG03	05JAN04																										



Rolling Wave Schedule

Acc BM Unique IDs	Activity Description	DD Start	Current Finish	2003																									
				JUN 2	JUN 9	JUN 16	JUN 23	JUN 30	JUN 7	JUL 14	JUL 21	JUL 28	JUL 4	AUG 11	AUG 18	AUG 25	AUG 1	AUG 8	SEP 15	SEP 22	SEP 29	OCT 6							
S/C Guidance, Navigation & Control (GN&C)																													
2661	Definitize APM Subcontract	27JUN03	27JUN03																										
2709	Definitize SIRU Subcontract	27JUN03	27JUN03																										
2913	Definitize Subcontract	27JUN03	27JUN03																										
S/C Thermal Control (TCS)																													
2979	Create Basic Detailed Geometric Models	28APR03	29JUL03																										
2982	Create Basic Detailed Thermal Models	28APR03	29JUL03																										
2985	Sanity Checks on Detailed Models	30JUL03	30OCT03																										
2988	Create Prelim Temp Predictions w/Detailed Model	30JUL03	30OCT03																										
2991	Compare Results of Simple Mods to Detailed Moc	30JUL03	30OCT03																										
3063	Definitize Heat Pipe Subcontract	15JUL03	15JUL03																										
S/C Electrical GSE (EGSE)																													
3132	SAS Rack Development	19NOV02	22JUL03																										
3129	MLS Rack Development	02JAN03	06AUG03																										
3135	Design Hot Bench Rack	20JUN03	10SEP03																										
3138	Design Hot Bench Cables	04AUG03	22SEP03																										
3150	Design Test Harness	21JUL03	22SEP03																										
S/C Simulators																													
3249	S/C Sim (SIIS) Functional Test	18NOV02	02JUL03																										
3252	Pack & Ship S/C Sim (SIIS)	03JUL03	09JUL03																										
3255	S/C Sim (SIIS) Deliver to GBM	09JUL03	09JUL03																										
3258	Software Updates to S/C Sim (SIIS) #1	10JUL03	15JUL03																										
3261	S/C Sim (SIIS) Deliver to LAT	15JUL03	15JUL03																										